

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Aeroqual
Model AQY v0.5

Pollutants:
NO₂

Measurement Range:
0 - 500 ppb

Type: Gas Sensitive
Electrochemical (GSE)



Additional Information

Field evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/field>

Lab evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

AQ-SPEC website:

<http://www.aqmd.gov/aq-spec>

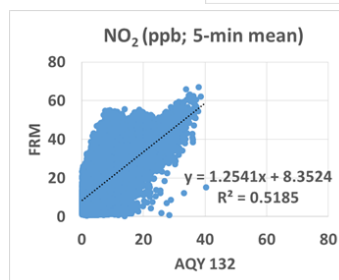
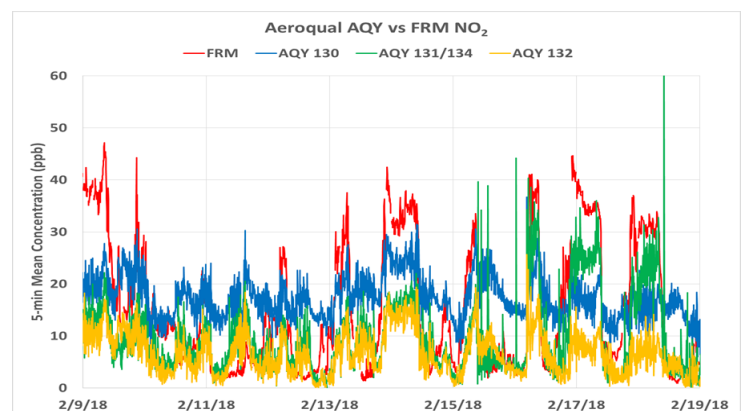
Evaluation Summary

- Overall, the three Aeroqual AQY sensors showed low accuracy. They underestimated the FRM NO₂ measurements for a concentration range between 0 to 150 ppb.
- The three Aeroqual AQY sensors exhibited moderate to high precision for most of the tested T/RH combinations in the environmental chamber, except at low NO₂ concentration under all T/RH combinations, in which precision could not be determined.
- Aeroqual AQY sensors showed substantial intra-model variability in the field deployment and low to moderate intra-model variability in the laboratory testing.
- Aeroqual AQY sensors had good data recovery (> 85 % for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For NO₂, the Aeroqual AQY sensors showed a moderate correlation with the reference instrument in the field ($R^2 \sim 0.50$) and showed a good correlation with the FRM instrument in the laboratory studies ($R^2 > 0.98$).

Field Evaluation Highlights

- Deployment period 12/22/2017- 03/27/2018: the Aeroqual AQY sensors (units IDs: 130, 131, 132, 134) showed moderate correlations with NO₂ concentration changes as measured by the FRM instrument.
- The units showed > 85% data recovery as well as substantial intra-model variability.

$R^2 \sim 0.50$



Coefficient of Determination (R^2) quantifies how the three sensors followed the NO₂ concentration change measured by the FRM instrument.

An R^2 approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

Laboratory Evaluation Highlights

Accuracy

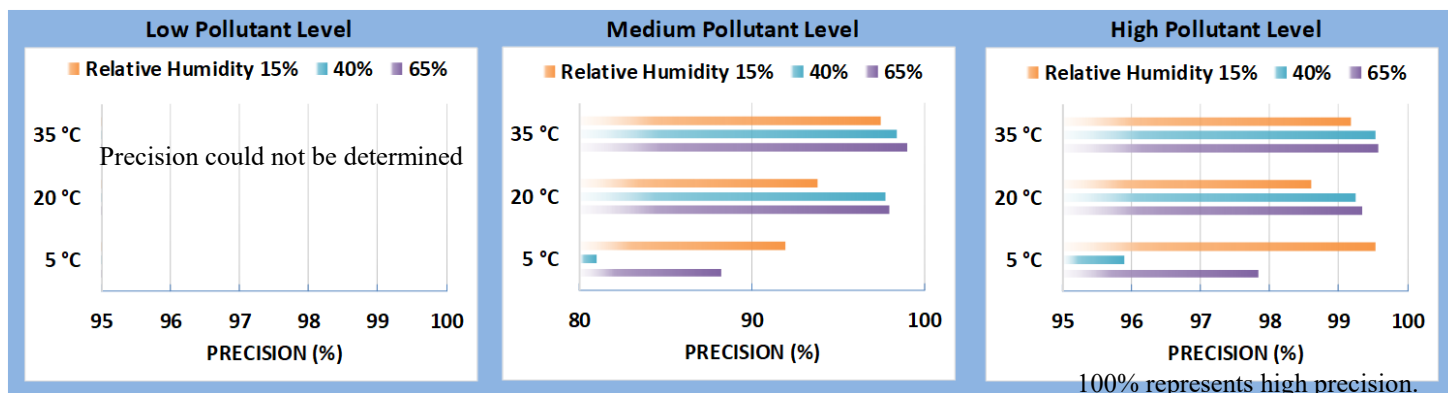
$$A (\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor mean (ppb)	FRM (ppb)	Accuracy (%)
1	N/A	14.4	N/A
2	0.9	34.1	2.6
3	10.2	75.9	13.4
4	20.6	123.0	16.7
5	32.2	170.0	18.9

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument. A negative % means that sensors overestimate reference instrument's reading by 2 folds.

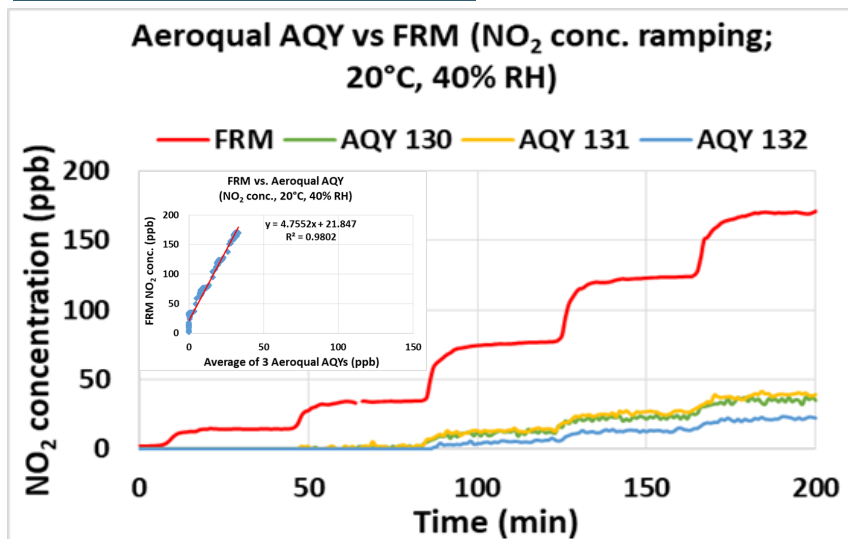


Precision (NO₂)



Sensor's ability of generating precise measurements of NO₂ concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5 °C and 15%), cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

Coefficient of Determination



The three Aeroqual AQY sensors showed good correlations with the corresponding FRM data ($R^2 > 0.98$) at 20 °C and 40% RH.

Climate Susceptibility (Coefficient of Determination R²)

R ²	5 °C	20 °C	35 °C
15%	0.920	0.960	0.983
40%	0.802	0.980	0.986
65%	0.921	0.968	0.994

Observed Interferents

Ozone interfered with the NO₂ measurements



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